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AUTHOR Sheets, Robert G.
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ABSTRACT

Establishment of a national-state system of world-class occupational skill standards is a first step in restructuring adult vocational-technical education and job training programs. Occupational skills standards provide the necessary foundation for addressing three major state policy issues: the state's proper role in private work-based training, improved effectiveness and efficiency of public programs, and development of a public-private credentialing system that promotes worker mobility. The German Dual System has been proposed as a model for transforming the vocational education and job training system in the United States. As shown by the Illinois Manufacturing Tech Prep Project, development of national skill standards should be based on certain assumptions about the role and structure of skill standards in state work force preparation programs: development of world-class standards, need for basic enabling skills and independent role performance, standards based on federal-state labor market policies, state education goals and implementation of applied academics, and skill assessment and credentialing. A national-state system of occupational skill standards can be constructed by building the following national-state systems: industry skill corporations, training occupations, occupational skill standards, professional and technical credentials, performance standards systems, and regulatory policies for public and private training providers. Appendices include three figures and sample skill standards from the Illinois Tech Prep Project. (Contains 38 references.) (YLB)

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Building a World-Class Front-Line Workforce: The Need for Occupational Skill Standards in State Workforce Preparation Programs

by Robert G. Sheets

Program Director
Human Resource Policy Program
Center for Governmental Studies
Northern Illinois University

U.S. DEPARTMENT OF EDUCATION
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by Robert Sheets
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Introduction

The Commission on the Skills of the American Workforce, in their report entitled *America's Choice*, recently concluded that the United States will increasingly compete internationally on the strength of the American front-line workforce. States must play a major role in meeting America's competitive challenges because states finance and administer the largest share of government education and training investment in the adult front-line workforce (Johnston 1989; Carnevale 1986).

The major competitive challenge facing states is to establish a world-class front-line workforce with which businesses can achieve productivity and quality levels superior to those in other states and in other countries. This competitive challenge should be met through comprehensive state workforce preparation systems that direct and coordinate public and private training investment in the front-line workforce. The most immediate and pressing problem is upgrading and retraining the existing adult workforce. States should make a major commitment to train their adult front-line workforce to levels that are benchmarked to the highest in the world. States should develop new strategies to expand private-sector training investment in the workplace and improve the overall productivity and performance of public vocational-technical education and job training programs.

States should begin their efforts with a clear understanding of what front-line workers should know or be able to do in order to meet or exceed world-class standards in their respective industries and occupations. Unlike some of our major international competitors, including Germany, the United States has not established occupational standards at the national and state levels for front-line occupations, except for some licensed occupations. States cannot build world-class workforces without establishing world-class skill standards. These occupational skill standards are critical in setting long-term strategic goals for state workforce preparation programs and evaluating the effectiveness and efficiency of state investments in the front-line workforce.

This paper argues for the establishment of a national-state system of world-class occupational skill standards as a necessary first step in restructuring adult vocational-technical education and job training programs. The paper first addresses why states need a national-state system of

occupational skill standards to address problems in adult vocational education and job training. The next section addresses issues in the institutionalization of skill standards based on a discussion of the use of skill standards in the German Dual System. It then describes a possible approach to defining skill standards in the United States based on recent research on skill requirements in manufacturing and illustrations from the Illinois Manufacturing Tech Prep (MTP) project. The paper concludes with recommendations for building a national-state system of occupational skill standards in the United States.

I. The Role of Occupational Skill Standards in State Workforce Preparation Programs

The National Governors' Association, in *Excellence at Work*, recently recommended that states take a leadership role in establishing a dialogue with business and industry to define skill standards for state workforce preparation programs. These skill standards are critical for the future development of state economic development efforts in workplace modernization and customized training. They also are critical for state efforts to build comprehensive and coordinated workforce preparation programs that are based on common or compatible performance standards systems. Occupational skill standards provide the necessary foundation for addressing the following three major state policy issues:

1. What is the proper role for state government in financing and delivering training to adult workers participating in largely private work-based training programs?
2. How can state governments improve the effectiveness and efficiency of public vocational education and job training programs given higher quality standards from business and industry and shrinking public resources?
3. How can state governments create a seamless public-private credentialing system that promotes lifelong learning and the mobility of adult workers between public and private training systems throughout their working lives?

State Investment in Private Work-Based Training

The first major policy issue facing states is determining what is their proper role in financing and delivering training to adult front-line workers, especially employed workers who are participating in largely privately financed training programs. What types of training should government fund, and how can government assume a leadership role in expanding and improving private-sector training programs for front-line workers? Finally, how can government ensure that state investment is effective in building a world-class workforce and in improving the competitiveness of American business?

Competitive Benchmarking and Public-Private Work-Based Training

In American business, what is considered important is what gets measured; and, many times, what gets measured is what gets the most attention. The MIT Commission on Industrial Productivity, in their report entitled *Made in America*, concluded that the concept of competitive bench-

marking is now becoming more widely accepted in American companies. Leading companies increasingly are conducting studies of organizational units or functions within other companies that perform at world-class levels. These studies establish the competitive benchmarks that companies must meet in their efforts to improve competitive performance based on their core strategies and competitive problems.

American businesses are implementing new accounting systems that emphasize cost, quality, and flexibility standards that are clearly benchmarked to their major national and international competitors. Competitive benchmarking is increasingly seen as a critical step in developing competitive strategies in manufacturing (Porter 1986; Hayes, Wheelwright, and Clark 1988). Most large companies, such as Motorola and Ford, have established certified vendor programs that establish clear competitive standards for American manufacturers who wish to compete for supplier contracts. The Malcolm Baldridge Award has become a major standard for quality management in all manufacturing companies.

Some state economic development programs, such as the Michigan Modernization Service, have attempted to develop performance, organizational, and technology benchmarks as guidelines for assisting companies in improving their competitive position within their own industries. Federally funded projects have attempted to establish benchmarks for major industry sectors based on methods used in Japan and Europe (Bearse 1986). These competitive benchmarks and standards have been developed to encourage companies to recognize changing competitive requirements and take immediate action to reach or exceed industry standards.

Government has played a key role in establishing industry standards to improve the efficiency of private markets. The federal government has taken major steps to establish industry standards to ensure open and efficient markets for capital goods and equipment, as well as industry standards and common measurement systems and terminology for materials. The National Institute for Standards and Measures, as well as numerous quasi-public professional and industry associations, provides a national and increasingly international arena for industry standards.

We have a long way to go in establishing occupational skill standards for front-line workers in industries that are facing increased international competition. Occupational skill standards currently exist in only a few industries, such as health care, which are dominated by licensed occupations.

Federal and state governments have devoted considerable effort to standardize occupational classifications and provide some guidance on education and training requirements. This industry and occupational information, provided through the state occupational information coordinating committees (SOICC), has been extremely useful in planning and evaluating public programs. In addition, these systems have been useful to some companies in establishing internal employment and training systems and in providing a framework for industry-wide employment and training initiatives, such as apprenticeship programs.

Much more, however, is needed. National and state efforts to define common occupational skill standards would provide critical guidance to American companies in defining standards and training requirements for their front-line workers. These standards could be used to encourage modernization in American companies and to encourage these companies to use front-line training as a major strategy in improving their international competitiveness. Most importantly, these standards also would be important in clarifying the proper role of state governments in investing in privately financed work-based training programs through state customized training programs and state apprenticeship programs.

State Customized Training Programs

State economic development programs have undergone a major shift over the last ten years from a sole emphasis on industrial attraction and expansion to a broader strategy that includes a new emphasis on business retention and improving the competitiveness of existing manufacturing and service companies. Many states have focused on using their customized training programs as a major strategy to improve business competitiveness through the upgrading and retraining of front-line workers (National Governors' Association 1991).

State-financed customized training programs have become major components of state economic development efforts over the last 30 years. Recent studies have estimated that 53 state customized training programs operating in 46 states spent approximately $380 million in customized training projects with businesses in the 1989-90 program year (Creticos, Duscha, and Sheets 1990). Stevens (1986) observed that state-financed customized training programs emerged in the 1960s and 1970s as part of state efforts to compete with other states for business investment. In most states, they were established as highly flexible, streamlined programs that offered financial incentives to businesses to locate in the state or to expand employment. In the 1980s, many state programs shifted to a stronger emphasis on job retention and the retraining of existing employees (Ganzglass and Heidkamp 1986; Creticos, Duscha, and Sheets 1990). State-financed customized training programs, such as the Bay State Skills Corporation, also were established to reduce skill shortages and address training needs that public educational institutions could not respond to quickly enough. As a result, these programs have very broad economic development objectives and funding priorities that continue to evolve according to changing economic development priorities and in-state business demand for training assistance.

State-financed customized training programs raise critical state policy questions on the proper role of state government in financing and delivering workplace-based training to employed front-line workers (Creticos and Sheets 1990). These programs raise critical policy questions about what types of training states should subsidize and how we can be sure that training funds are being used to prepare workers to achieve productivity and skill levels equal to their counterparts in other states as well as to our international competitors.

Apprenticeship Programs

The Apprenticeship 2000 initiative of the U.S. Department of Labor and the National Governors' Association's *Excellence at Work* initiative have called on states to take a major leadership role in expanding apprenticeship and related work-based learning programs as part of more comprehensive workforce preparation systems. Since the passage of the National Apprenticeship Act in 1937, the United States has recognized apprenticeship programs as a critical private training system that should be promoted and supported through government policies. However, the apprenticeship system has remained small in comparison to the public postsecondary vocational-technical education system. In addition, most apprenticeship programs have been concentrated in the construction trades. Although the Bureau of Apprenticeship and Training within the U.S. Department of Labor promotes and regulates registered apprenticeship programs, the federal government currently does not provide funds to support adult training within privately administered apprenticeship programs. State governments provide only limited funding support, largely through state reimbursements to public educational institutions for providing related theory classroom instruction as part of registered or unregistered apprenticeship programs. Some state customized training programs also provide direct funding support to these programs (Creticos, Duscha, and Sheets 1990).

State initiatives to expand apprenticeship programs should

include efforts to improve the coordination between apprenticeship programs and postsecondary vocational education, especially in community and technical colleges. The Carl D. Perkins Vocational Education Act of 1984 (Perkins Act) encouraged strong cooperation between vocational education and apprenticeship programs through a variety of linkages, including pre-apprenticeship programs, related theory instruction, and instructor training (Meridian Corporation 1988).

State initiatives to promote and expand apprenticeship and related work-based training programs raise new questions about whether state governments should expand their direct support of these privately administered training programs. In most states, apprenticeship programs receive public funding for related theory instruction only when this instruction is provided in the form of a reimbursable public course sponsored by a recognized public educational institution. Although this funding mechanism does promote increased coordination between public educational institutions and apprenticeship systems, it takes away the discretion of private groups to organize and deliver training in the most cost-effective way, given the training needs of industry. This may undercut efforts to expand apprenticeship programs. Instead, states could consider alternative funding mechanisms to support related theory instruction delivered through public or private providers who adhere to state regulatory policies. Some states, including California, have experimented with special state discretionary grant programs. If states choose to directly finance apprenticeship training, they must clarify what types of training should be supported through public funds and what types of quality standards should be applied.

State Support for Private Work-Based Training Systems

Future state initiatives to expand state-financed customized training programs and apprenticeship programs would immediately raise questions about public support for a variety of private training arrangements within states. Approximately 50 percent of all formal adult training is financed and delivered through the private sector (Carnevale 1986; Johnston 1989). Private training programs are delivered through a variety of private organizations, including for-profit career colleges and proprietary schools, employers, industry associations, professional associations, unions, and other non-profit business and community organizations. The growth of private-sector training in recent years has sparked a significant growth in private non-profit and for-profit organizations that develop training programs and materials and/or deliver training through sponsoring organizations (Carnevale and Gainer 1990).

Most states now are considering the creation of private interfirm training networks among small- and medium-sized employers. These training networks already have been established in some states and have been used extensively in other countries (Bosworth 1991). For example, the federal government in Germany provides a significant grant to interfirm training centers administered by Chambers and other business groups. These centers provide apprenticeship training and upgrade training for other employed workers (Munch 1991).

New state initiatives to expand customized training programs, apprenticeship programs, and other forms of work-based training, especially interfirm training networks, will raise the same set of policy questions. What is the proper role of state government in financing and delivering training to adult workers participating in work-based training programs?

Government Role in General Skill Development in Work-Based Training

In order to rethink the traditional government role in supporting work-based training, we should begin to question some of our most basic policy assumptions that support current state financing and delivery systems. The government role in financing and delivering vocational education and job

training to adult workers traditionally has been clarified by a distinction between general and firm-specific training. Work-based training in the United States has traditionally been viewed by employers and government as a normal cost of doing business. Consequently, companies have had primary responsibility for conducting such employee training as is necessary for them to be competitive in their own industries. This policy perspective is based on two assumptions: (1) that employee skills acquired through workplace-based training usually are not transferable directly to other employers; and (2) that the employer who sponsors the training captures the major portion of the economic return through increased productivity. This perspective leads to the conclusion that government should invest only in general (i.e., transferable) academic and vocational-technical skills that are critical for industry competitiveness and economic growth. However, companies are unwilling to invest in training for these skills at optimal levels because of complex externalities and the uncertainty of obtaining an adequate return from their investment because of competitors who may hire their trained workers away.

Although the distinction between general and firm-specific training is useful in understanding the responsibilities of the public and private sectors in training, this distinction is very difficult to operationalize in making judgments about the typical training projects that are funded by state customized training programs. State customized training programs currently are making major investments in a broad range of basic skills, including reading and math, teamwork skills, problem-solving and decision-making skills, and oral and written communication. They also are making major investments in general occupational skills, such as blueprint reading and electronics, which are commonly found within the core curricula of publicly funded, school-based vocational education and job training programs (Creticos and Sheets 1990). In many cases, state-financed customized training programs are financing the same or similar types of training through an alternative training strategy and delivery system.

The United States has built a large school-based vocational education and job training system on the assumption that most training that occurs away from the workplace and in classes and that allows enrollments from more than one company meets the criteria of general skills training and should be subsidized through government. This assumption fits well with our current school-based system. The largest share of public funding for vocational-technical education and job training in the United States is based on funding support for accredited schools and approved courses delivered through publicly accessible classroom courses. However, this policy results in major barriers for adult workers, who are unlikely to participate in education and training activities in publicly funded schools but are likely to participate in workplace-based training programs.

State-financed customized training programs, as well as apprenticeship and other forms of work-based training, can be supported on a rationale that most workplace-based training provides employees with academic and occupational skills that can be easily transferred to other employers. In addition, these programs can be promoted on the argument that work-based training provides the most cost-effective strategy for general skill training because workers can acquire skills more effectively through specific firm and job applications, and government does not have to finance the large overhead costs for advanced technical training, which includes qualified instructors and equipment.

The competitive advantages for general skill development through the workplace are likely to grow in the future because of two major factors. First, school-based systems are likely to experience great difficulty in remaining current in advanced technical training because of shortened technology and training life cycles (Flynn 1988). Second, recent research on adult learning and instructional design has

argued for stronger emphasis on applied learning through work as a major strategy in vocational education and job training, similar to the work-based training systems in other industrialized countries (U.S. Department of Labor 1989).

The future growth and development of state customized training programs, apprenticeship programs, and other work-based learning programs requires a rethinking of our assumptions about the provision of general skills in work-based training. The most effective approach is to fully operationalize a common set of general academic and vocational-technical skills required in major industries and occupations and provide government financing and regulatory support for general skill development through either school- or work-based training systems. In this approach, occupational skill standards would provide a clear statement of the public responsibilities and priorities in worker training. Given these standards, government programs could recognize business and industry groups and schools as alternative service providers to deliver the same types of general training. A national-state system of occupational skill standards would provide critical guidelines for state customized training programs and state efforts to promote apprenticeship programs and interfirm training networks.

Public Program Productivity, Accountability, and Coordination

The second major policy question is how state governments can improve the effectiveness and efficiency of public programs given higher quality demands from business and industry and limited public resources. How can state governments improve the productivity of public programs through program innovation, stronger accountability, and better coordination of resources?

During the 1960s and 1970s, federal and state governments undertook numerous efforts to coordinate federal, state, and local vocational-technical education and job training programs. These efforts attempted to improve the efficiency and effectiveness of government programs by increasing the compatibility and consistency of programs that provided a wide variety of services to diverse client populations. During the 1980s, program accountability and improving the efficiency and effectiveness of public programs became the central concerns. Major federal and state efforts were launched to monitor and evaluate programs based on new performance standards systems. During this period, federal and state governments undertook major initiatives to modernize public training programs and educational institutions through the introduction of new instructional approaches and instructional technology. These efforts were designed to improve the effectiveness and efficiency of public training programs.

During the 1990s, federal and state governments should work together to merge coordination, productivity, and accountability efforts by using performance standards systems to coordinate programs through common performance objectives and outcomes and to spur major program initiatives to improve productivity and lower costs. The foundation of this strategy should be occupational skill standards.

Federal-State Performance Standards Systems

The implementation of the Job Training Partnership Act (JTPA) in 1982 marked the beginning of a major shift in federal and state workforce preparation programs to new types of accountability systems that evaluate programs based on performance versus design standards. As defined by Salamon (1981), design standards address detailed aspects of the internal administration and operation of a program. They include administrative structures and procedures, service mixes, staff qualifications, and financial accounting and reporting. Design standards are the foundation for accountability systems in state-financed and regulated educational institutions and professional accreditation

systems. In contrast, performance standards refer to the outcomes or results of the program, leaving internal administrative and program design standards to the discretion of the service provider.

In implementing the JTPA, the U.S. Department of Labor established a national-state system of performance measures and standards that evaluated JTPA programs based on the employment and earnings experiences of adult participants. It also established a youth competency system that allowed local Private Industry Councils to define youth competencies under federal and state guidelines in three major areas: (1) employability skills, (2) academic skills, and (3) vocational or occupational skills. The JTPA youth competency system was designed to evaluate the performance of service delivery areas (SDAs) in providing youth with the certified skills necessary to make a transition from school to work.

The Family Support Act of 1988 established a mandate to develop a similar performance standards system for state welfare-to-work programs funded under the Job Opportunities and Basic Training Program (JOBS) beginning in 1993. This performance standards system will be based on performance measures and standards similar to JTPA in addressing employment and earnings and the reduction of welfare dependency.

The passage of the 1990 Amendments to the Perkins Act (Perkins Amendments) marks the first time that federal vocational education legislation has required a state-administered system of performance standards and measures. The Perkins Amendments require states to develop and implement a state-wide system of standards and measures of performance for secondary and postsecondary vocational-technical education by September 1992. The Perkins Amendments require state performance standards systems to include measures of learning and competency gains in basic and more advanced academic skills as well as performance measures in one or more of the following areas: competency attainment, work skill attainment, completion of school, and placement into additional training or education, military service, or employment (Baj and Sheets 1991).

The implementation of the Perkins Amendments is accompanied by national and state efforts to establish stronger performance standards for postsecondary educational institutions and private career colleges and proprietary schools enrolling students with federal-student grants and loans. For-profit proprietary colleges and trade schools have become major users of publicly financed students grants and loans (Fitzgerald and Harmon 1988). Recent concerns about growing student default rates and program quality have prompted national and state efforts to recommend stricter design and performance standards on all postsecondary vocational education and job training programs.

The Perkins Amendments have major implications for state workforce preparation programs because they establish applied academic and vocational-technical competencies as a core component of state performance standards and accountability systems. They also encourage states to coordinate and integrate their state performance standards systems under the Perkins Act, JOBS, and JTPA. The legislation encourages states to develop common or consistent standards and measures wherever possible to encourage greater program coordination.

The major problem in developing performance standards and measures in applied academic and vocational-technical competence is the absence of a national or state system of occupational skill standards from which to construct statewide assessment programs. The major impetus for and control over the development of skill standards should rest with the private sector. The first barrier to overcome is that business and industry in the United States have not been sufficiently organized to develop and transmit a clear and consistent statement to vocational-technical education and job training programs on required skills for major occupa-

tions. American manufacturers have gone to great lengths to clarify material and product standards for all material inputs into their facilities. They also have used advanced computer and telecommunications technologies to give even more precise "work orders" to their major suppliers and vendors. They have yet, however, to develop a clear set of work orders for the most crucial supplier for world-class manufacturing: the vocational-technical schools and job training programs that supply the future front-line workforce.

The second barrier lies in the traditional American commitment to the local control of public education. This has resulted in strong local control of vocational-technical programs in high schools and community colleges, which has been reinforced by a similar commitment to local control in JTPA programs through the authority of the local Private Industry Councils. Most state vocational-technical education systems are based on a commitment to the local definition of occupational skill requirements. Although most states establish strong state-wide labor market planning guidelines, the major responsibility for the definition of standards remains at the local level. Without common state-wide occupational standards and state-wide standardized assessment, state performance standards systems will be very difficult to develop because student performance across programs for the same occupation will not be comparable.

State Policy and Program Coordination

Federal and state coordination initiatives in the 1960s and 1970s were based on a corporate or bureaucratic model of program coordination (Whetten 1981). This model attempts to increase administrative coordination through the development and implementation of administrative agreements that define the respective roles and responsibilities of each program as well as administrative procedures to carry out these agreements (Sheets, Baj, and Harned 1988).

These coordination efforts often fail because these agreements are not based on common or compatible performance objectives between programs. These efforts beg the question, coordination for what common purpose? If two programs are not pursuing common or complementary performance objectives, the incentives for coordination are too weak to sustain effective cooperation in the long run. For instance, one program may be evaluated based on the number of participants who achieve a certain reading and math level and complete a pre-employment skills program, whereas another program may be evaluated on job placement. The participant likely will be pulled in two different directions. These inconsistencies will destroy any efforts to improve administrative coordination.

An alternative approach is to begin with policy coordination. Policy coordination refers to the development of consistent program objectives, quality standards, and program terminology, with a major emphasis on common measurable performance outcomes by which each program will evaluate effectiveness (Sheets 1989; Sheets and Stevens 1991).

The development of state-based performance standards systems under Perkins legislation provides a promising framework for establishing strong policy coordination in performance standards systems in JTPA, JOBS, vocational-technical education, and, in the future, adult and higher education. The Perkins Act requirements have the potential to encourage state programs to work together in establishing common performance objectives and outcomes in academic and vocational-technical skills. These common outcomes could ensure that all program participants will be assessed and evaluated based on common or compatible skill standards wherever they go in the system.

In order to be successful, these state coordination efforts should be expanded to include apprenticeship programs and other work-based learning programs sponsored by businesses and unions. Given the size and growth of the private-sector

training system in the United States, we cannot afford to exclude over 50 percent of the training industry. Policy coordination should address the need to coordinate both the public and private training systems around common or compatible performance objectives and outcomes, even for programs that are financed and delivered totally through the private sector. The foundation of these efforts should be the development of occupational skill standards through joint efforts with business and industry.

Public Productivity and Technological Innovation

Carnevale (1986) recently estimated that the American public and private vocational education and job training system is a $453 billion industry that is likely to continue to grow rapidly over the coming years. Like all other industries, the American training industry is undergoing major changes due to changing consumer requirements and major innovations in the underlying technologies of the industry, including adult learning theory and modern instructional technology. If these changes continue, new instructional technologies, such as computer-based instruction, integrated video, and teleconferencing, will increasingly dissolve the competitive advantages of school-based classroom instruction, especially for adult workers who prefer training that is closely integrated into home and work (Sheets 1989). Although alternative instructional approaches with modern instructional technology have proved more cost-effective, the public sector, especially the public schools, has fallen behind the private sector in using modern instructional approaches and technologies to improve efficiency and effectiveness (Office of Technology Assessment 1991). State governments must meet the rising expectations of the private sector in the preparation of the front-line workforce with even less resources than they had in the 1970s and 1980s. This will require major changes in how public education and training programs incorporate new technology and restructure their teaching methods.

States first should establish clear performance objectives that they must reach through the use of modern instructional approaches and technology. These performance objectives must be central to the operation of the schools and the evaluation of instructional personnel. Schools and instructional personnel must be given the flexibility to use modern instructional technology and methods in reaching these performance objectives based on their own unique situations.

Occupational skill standards provide the foundation from which to define and mark progress toward measurable performance objectives. Performance standards systems provide the framework from which to define these objectives and evaluate state efforts to improve productivity and encourage innovation in public vocational education and job training programs.

Worker Credentialing and Mobility in Market-Based Systems

The third major policy issue is how state governments can improve the coordination between public and private training programs so that workers can accumulate and build on training credentials from both the public and private sectors. How can state governments develop a seamless public-private credentialing system that promotes the mobility of workers between public and private training systems?

State-supported community and vocational-technical colleges and universities and federal and state student grant and loan programs have had a major impact on the participation of adults in postsecondary vocational-technical education. However, the United States does not currently have an integrated system of vocational education and job training that provides clear paths for front-line workers in preparing for professional and technical careers. The National Assessment of Vocational Education, in a three-year study

of vocational-technical education in the United States, concluded that greater efforts must be made to construct coherent sequences of courses and programs of study related to an occupation or career.

The implementation of Technology Preparation (Tech Prep) programs in states that are promoted through new federal legislation will likely improve the linkages between secondary and postsecondary school-based programs in the United States. The Tech Prep model emphasizes a fully articulated curriculum between vocational-technical programs in high schools and community colleges, ending in a two-year associate degree that can be capstoned with a four-year college degree. Tech Prep programs can have significant work-based learning components through internships and cooperative education. They also can be linked to preapprenticeship and apprenticeship programs, especially those programs that receive related theory instruction through vocational-technical schools and community colleges (Sheets, Trott, and Yip 1991).

Numerous national efforts have been made to establish credentialing systems in the private and public sectors and to improve worker mobility between the two sectors. The North American Auto/Steel Curriculum Research Foundation, the National Tooling and Manufacturing Association, the National Institute for Automotive Service Excellence, and Printing Industries of America are just a few of the national organizations that have developed national standards or related curriculum materials for specific occupations (Albright 1991). The American Council on Education's Program on Noncollegiate Sponsored Instruction (PONSI) is an example of national efforts to establish transferable worker credentials (Spille 1989).

Although Tech Prep programs and these national efforts have made important contributions to advancing the possibility of a national-state credentialing system, the time has come to integrate these efforts into a new public-private system.

In *America's Choice*, the Commission on the Skills of the American Workforce recommended the establishment of a comprehensive system of professional and technical certificates and associate degrees for the majority of workers who do not pursue a baccalaureate degree. The Commission recommended that the Department of Labor convene national groups of business, labor, education, and government to define certification standards for programs in a broad range of occupations. This system would provide clear paths for youth and adult workers to pursue lifelong learning and improve their career opportunities. Students could earn initial occupational certificates through combined work and study programs and then proceed to advanced certificates and associate degrees and, eventually, to entry into four-year degree programs.

The major challenge in integrating the public and private sides of the training industry in the United States is developing a flexible, competency-based credentialing system that is based on what workers know and can do rather than on how or where they learned it. Such a credentialing system would promote the transfer of skills from work-based training programs and private training credentials to school-based degree programs, thereby reducing the transfer costs between the public and private systems.

This new credentialing system should be developed and managed through new public-private partnerships consisting of education, business, labor, and government. As recommended by the Commission on the Skills of the American Workforce, such a credentialing system should be managed through public-private boards or organizations that can command the credibility and support of both public schools and business and industry. We can no longer afford to protect the monopoly power of public educational institutions in awarding professional and technical credentials for the

front-line workforce. We should develop a public-private credentialing system that gives support and legitimacy to private, work-based training systems and that allows workers to move freely between the public and private sides of the American training industry in pursuing industry-recognized training credentials (Sheets 1989).

A public-private system of professional and technical credentials governed by external boards would create a more open, market-based training industry in the United States (Sheets and Stevens 1991). Such a system would allow workers to choose between public or private training programs based on individual needs and the relative costs and effectiveness of these programs in getting workers proper credentials and good jobs. It would also allow government financing to move to those programs that produced the best results. State customized training programs could design their training contracts so that workers could make progress toward recognized industry credentials. Finally, such a system would allow employers to make more efficient "make or buy" decisions in developing their own training programs and in contracting with the public or private training providers that have been successful in training workers according to recognized industry standards.

The key challenge is again establishing a set of occupational skill standards that are supported and used by business and industry and that can provide the proper foundation for a credentialing system for both private and public training programs. Although industry skill standards are contained in many existing credentialing systems, especially licensed professions that require state examinations, most credentialing systems are based on loosely defined program and institutional accreditation (Wilms 1986). Students are given credentials if they successfully complete a course of study defined by the educational institution or training provider. A new credentialing system will require the formulation of industry skill standards and examination systems for all professional and technical occupations.

II. Role and Structure of Skill Standards in the German Dual System

In comparing the United States to its major international competitors, especially industrialized European countries, critics have argued that the United States lacks a comprehensive and structured school-to-work transition system for non-college-bound youth. It also lacks a recurrent training system for both employed and unemployed adult workers. The United States has been criticized for building a school-based, supply-side system that is detached from labor market needs and the training activities of employers and unions (Osterman 1988).

The German Dual System has been proposed as a model for transforming our vocational education and job training system in the United States. Proponents focus on the inherent advantages of apprenticeship as an effective school-to-work strategy and as a superior approach to adult training. The German Dual System also provides useful lessons in the definition and utilization of skill standards in vocational education and job training programs.

Federal Training Regulation and Credentialing

The vocational education and training system in Germany, like in the United States, consists of a loosely joined patchwork of federal and state (Lander) programs administered through public educational institutions, non-profit organizations, business and industry organizations, and private firms (Munch 1991). However, unlike in the United States, the initial training of skilled front-line workers takes place mainly within the Dual System.

The Dual System refers to the fact that training takes place in two separate places of learning that have differing legal and organizational frameworks: training within industry and training within schools. Training within schools is conducted approximately one to two days per week in vocational schools governed by the cultural ministries of the federal states. In contrast, training within industry is standardized and controlled for the country as a whole through federal legislation in the form of the Vocational Training Act. This act provides the legal and organizational framework for a comprehensive and detailed set of occupational standards for the industry training component of the Dual System.

In the industry training component of the Dual System, Federal Ministries governing each trade establish training ordinances in cooperation with the Federal Ministry of Education and Science. These training regulations are developed and disseminated through the Federal Institute for Vocational Training (BiBB), which is administered by the Ministry of Education and Science. The BiBB is governed by a central committee representing government, education, and the major "social partners," including business and labor. This committee consists of eleven representatives from employers, workers, and the Lander, together with five representatives from the federal government. The committee also has a permanent subcommittee, the Lander Committee, which works to articulate new training ordinances with new curriculum standards for the school component of the Dual System. In addition, through the authority of the Central Committee, the BiBB periodically appoints Committees of Experts to create new training ordinances or revise existing ordinances based on a legally established process.

The composition of the central committee and the legal and organizational framework surrounding the BiBB ensure equal voices from business, labor, and education in the development of training ordinances for training occupations. They also provide a public-private governance structure for the Dual System, which is critical in gaining the support and participation of business and industry.

Under the Federal Vocational Act, initial training in the industry component of the Dual System must be conducted in "recognized skilled occupations" on the basis of national training ordinances. These training ordinances specify the designation, the duration of training, the knowledge and skills to be received through training, directions for the organization of instruction, and examination requirements for the final qualifying examination.

Federal training ordinances establish a structure of occupations within a particular industry or occupational field (see Figure 1, Appendix A). The designation of skilled occupations addresses both the general trade and the field of specialization. These training ordinances also provide a description of the skilled occupation and a detailed training plan (see Figures 2 and 3, Appendix A). The outline training plan is disseminated through large booklets with extensive details on technical requirements and the chronological order of training. The training outline is only an abstract of the larger outline training plan for an occupation. Together with the examination requirements, this training plan provides a clear statement of what workers should know or be able to do to qualify as skilled workers within a recognized occupation.

These training ordinances are administered and enforced through legally recognized "competent bodies." For most training occupations, these competent bodies are the Chambers of Commerce and Industry and the Crafts Chambers. The Chambers are administered through their Vocational Training Committees, which consist of six employer representatives, six employee representatives, and six vocational school teachers. The major responsibilities of the Chambers are to promote vocational training through the counseling of trainers and trainees; approve training contracts based on the federal training ordinances; determine the suitability of the training firm; monitor the quality of training programs; admit candidates to the intermediate and final qualifying examination; and develop and conduct the final examination through an appointed examination board. The Chambers maintain records on all approved training contracts and the results from final qualifying examinations. Although the Chambers are not required to conduct a standardized national examination in each recognized occupation, these examinations are becoming increasingly standardized due to the increased levels of detail in the federal examination requirements and the increased cooperation of Chambers in developing and using common examinations.

The federal training ordinances and the Chambers are critical in maintaining consistent quality standards throughout the country, especially in recent years, which have been characterized by a proliferation of new organizational arrangements for industry training. Originally, training in industry referred to on-the-job training closely associated with the normal routines of work within a particular company. Increasingly, training in industry is occurring in industry classrooms and training facilities that are owned and sometimes shared by large- or medium-sized companies or in separate state-financed training centers that serve small- and medium-sized employers who cannot provide the required training on their own.

Restructuring of Metalworking Occupations

During the 1980s, the German Dual System underwent a major transformation in the structure and content of most recognized training occupations. This restructuring involved the broadening and lengthening of occupational training (Streeck 1991), which involved a major restructuring of training occupations for the metalworking industry. In Germany, the metalworking industry includes the entire range of industries dealing with metal materials and their substitutes, ranging from small component parts and specialty items to automobiles and aircraft. This sector represents about 4 million employees out of a workforce of approximately 22 million workers (Streeck 1991). The restructuring resulted in the consolidation of 34 skilled metalworking occupations into five recognized occupations involving 16 occupational specialties.

These occupations roughly correspond to the titles of Industrial Mechanic, Tool and Die Maker, Machinist, and Sheet-Metal Worker in the United States, along with some broader specialty areas. All apprentices in the metalworking industry are required to undergo approximately one year of general training, which provides a foundation for all occupational training. Intermediate examinations are given to apprentices in the middle of the second year according to their trade-specific training. Apprentices then undergo in-depth training in one of 16 specialty areas for the final two years. Final examinations are then given to apprentices in one of the specialty areas.

The most sweeping change in the German Dual System has been the addition of the one year of general trade training. This sweeping change was driven by three major considerations. First, the changes in the modern workplace made many traditional apprenticeship occupations obsolete. Second, the modern workplace required broader training to allow greater flexibility and more emphasis on independent planning, execution, and evaluation of work in

self-directing, inter-occupational work teams. Third, some student apprentices required more time to meet the new entry-level requirements for trade-specific training. Some students did not have the basic academic training necessary to enter apprentice training. In addition, it was felt that some students needed more time to explore career opportunities within a particular occupational area before choosing a training specialty.

Lessons from the German Dual System

The German Dual System provides useful lessons in the role and structure of skill standards within a national vocational training system. The most important lessons are the following:

1. Public-Private Governance. Skill standards must be established through a public-private institutional structure that can build consensus on these standards in both the public and private training systems in the United States. Public-private consensus on standards provides the basis for the effective administration of a complex system of training involving the coordination of public schools, independent training centers, and on-the-job training within companies.
2. Recognized Training Occupations. The establishment of skill standards requires the establishment of nationally recognized training occupations. Given industry trends and the importance of worker flexibility and mobility, these training occupations should represent broad professions or trades within a network or hierarchy of related trades within an industry.
3. Performance Management and Worker Credentialing. Skill standards provide a necessary framework for maintaining public and private accountability in worker training through an independent competency-based credentialing system and the certification and licensing of training sites according to training ordinances and student performance on standardized examinations.

The German Dual System also provides useful lessons on three potential problems with the use of skill standards in vocational training programs. First, a complex public-private governance system for skill standards must be based on a strong business and industry commitment to financing and delivering front-line training and on strong public-private partnerships in planning and administering vocational education and job training. The United States does not have a strong tradition of private training and public-private partnerships from which to build a public-private governance system for skill standards. Second, a complex public-private system of skill standards may be difficult to change in response to rapidly changing training requirements in the modern workplace. The recent revision of training ordinances for most skilled occupations in Germany over the last ten years has convinced many critics that a national system of skill standards can be changed to meet new training requirements of industry (Casey 1990). Still, the problem of adaptability is an open question that needs to be addressed in creating a similar system in the United States. Third, public-private consensus on training ordinances many times results in minimal skill standards that are acceptable to schools and companies with limited training resources. This may result in benchmarking standards to the lowest common denominator within the industry as opposed to world-class skill requirements. The recent upgrading of skill standards in the metalworking and chemical trades and the expansion of government-financed interfirm training centers for small businesses to meet the new training requirements suggest that this problem can be successfully overcome if a system of world-class standards is developed in the United States. However, significant problems still can be expected in reaching consensus on world-class standards within private industry and the educational community.

III. Developing Skills Standards in the United States

Most states are now experimenting with new Tech Prep and European apprenticeship models in order to improve vocational-technical education for both youth and adult workers. Many states, such as Maryland, Illinois, Wisconsin, and Pennsylvania, are putting a strong emphasis on the metalworking industry. Illinois recently initiated a state-wide Manufacturing Tech Prep (MTP) project to establish a school-to-work transition system in manufacturing technology. The project is designed to integrate the strengths of Tech Prep programs supported in the new Perkins Act and work-based learning models, which are being promoted by the U.S. Department of Labor and are based on European apprenticeship models. The project was developed through a state-wide collaborative planning effort among business, labor, education, and job training leaders. This planning effort merged two state-wide initiatives: one from the Illinois State Board of Education on Tech Prep Programs; and the other from the Illinois Job Training Coordinating Council exploring work-based learning approaches for vocational education as well as job training programs for dislocated workers and both in-school and out-of-school disadvantaged populations.

This project was based on the premise that the integration of Tech Prep and apprenticeship models requires the development of state skill standards that will be recognized by government, education, business, and labor. This project has begun to identify occupational skill standards that define the skill requirements for entry-level manufacturing technology occupations in world-class metalworking companies. The project started with the development of an occupational framework and skill standards for entry-level precision metalworkers.

Major Considerations in Defining Skill Standards

Based on the early experiences of the Illinois MTP Project, the development of national skill standards should be founded on a number of assumptions about the role and structure of skill standards in state workforce preparation programs.

World-Class Standards and Economic Development

As discussed earlier, occupational skill standards should be developed as world-class standards that encourage businesses to invest in higher skills for their front-line workers.

Vocational training policy should serve as one type of competitive benchmark that employers and industry groups can use to develop modernization strategies and improve their competitive standing in their industries. As a result, these standards may reflect the skill requirements of only a small number of leading companies in a state or local area. These standards will likely be much higher than the skill standards used in hiring and training decisions in most companies, especially small- and medium-sized companies. This represents a major change in the role of occupational skill standards in the development of vocational education and job training programs in most states.

Basic Enabling Skills and Independent Role Performance

As discussed earlier, the major impact of world-class manufacturing is the need for front-line workers to have stronger basic skills, including problem-solving and decision-making skills. This will necessitate that all skill standards require workers to utilize basic reading comprehension, written and oral communication, and problem solving and scientific reasoning in the performance of broad work roles in which they are asked to independently plan, execute, monitor, and evaluate their own individual and group work. Most existing materials on skill competencies address detailed work tasks for specific jobs or occupations based on Tayloristic concepts of work design and control. These materials must be rewritten so that separate skill competencies and work tasks are put together in open-ended role or duty performance utilizing problem-solving and decision-making skills.

Federal-State Labor Market Policies

Occupational skill standards also should be based on broader social and labor market policies that define what workers must know in order to: build careers and pursue lifelong learning; legally practice a trade or profession within a state; ensure worker safety and worker rights and protections; and ensure compliance with business laws and regulations, including environmental protection. The training regulations in the Dual System put strong emphasis on this type of training. The United States has clear worker safety and environmental protection standards that must be built into the occupational skill standards that are used in state workforce preparation programs. In addition, states define certification standards based on licensing examinations and required training. Although these certification standards usually are not applicable to front-line workers in manufacturing, they should be a major starting point in developing standards in other occupations, especially in state-regulated occupations such as in the health industry.

State Education Goals and Applied Academics

The foundation of any state workforce preparation system is a strong school-to-work transition system that establishes state standards of educational performance for all high school students based on federal and state goals for learning. The National Goals for Education established national goals for learning that will likely have a major impact on most vocational education and job training programs.

Most state departments or boards of education have already established state learning goals for high school students as well as state-wide testing systems that are benchmarked to the National Assessment of Educational Progress and related national and international comparisons. These state standards are likely to become the foundation for higher academic skill requirements in state workforce preparation programs, especially in reading comprehension, written communication, science, and mathematics. The implementation of Tech Prep programs in states will require an integration of academic and vocational-technical education in high schools, with students expected to reach state

learning goals as well as industry requirements in vocational-technical skills. Occupational skill standards should be developed cooperatively between schools and industry groups so that standards reflect both industry needs and educational goals and so that schools can fully understand how to work with industry to train students according to occupational skill standards. In order to accomplish this, these standards must be "unpacked" into basic enabling, advanced academic, and vocational-technical skills so that schools can see the relationship between state learning goals and occupational skill requirements and can understand how academic skills must be applied within the modern workplace.

Skill Assessment and Credentialing

Although most states now assess academic skills through standardized testing, this approach may not be the most appropriate way to assess skills for the modern workplace. Although standardized tests may be good predictors of success in postsecondary education, they may not be good predictors of productivity in the workplace. As a result, they have been criticized by many groups on their use in hiring and employment decisions in the workplace. Skill standards should be written in a way that broadens assessment practices for front-line workers. In following practices in Germany, states should consider a broader assessment strategy involving written and oral examinations, project performance, and portfolio analysis.

Perkins Requirements and State Skill Standards

The Perkins Act provides a promising opportunity to develop standards that meet all these considerations. It mandates that states develop and implement a state-wide system of core standards and measures, including measures of job or work skill attainment. The Perkins Act also promotes the integration of academic and vocational-technical education, the broadening of training to address all aspects of the industry for which students and workers are being trained, and training for new skill requirements in industry that includes advanced problem solving and decision making. The Perkins Act provides a useful framework from which to construct occupational skill standards for all state workforce preparation programs.

An Illustration for General Production Technician Occupations

Classification of Recognized Training Occupations

In following the German model, the development of occupational skill standards first requires the definition of core training occupations and their relationship to recognized occupational titles and job descriptions. The metalworking industry can be defined by the SIC codes 35 and 36 where most precision metal workers are employed. The world-class workplace is increasingly combining semi-skilled and unskilled metalworking occupations into broader classifications that emphasize cross-training and multi-skilling. The German Dual System has been restructured to promote one year of initial preparation in which all apprentices are provided with broader training for the entire metalworking industry.

After reviewing the reorganization of metalworking trades and professions in Germany, the Illinois project developed a proposal to consolidate all semi-skilled training into a common entry-level training occupation called General Production Technician. This would be similar to the first year of general industry training now required in the German apprenticeship system for metalworking trades. This occupation would involve broad training in areas that would prepare a student for entry into four broad trades or professions in metalworking industries: (1) Industrial Equipment Technician, (2) Tooling Technician, (3) Machining Technician, and (4) Sheet Metal Technician. These four trades

contain ten major specialty areas and provide the basis for capstone training in industrial management and engineering (see Appendix B).

The proposal recommends that the training period for General Production Technician should be about one year, resulting in the first-level metalworking examination. The duty standards outlined below would provide the basis for that examination. Trade training would extend for another year in one for the four trades or professions and would culminate in the second level examination, similar to the intermediate examination in the German apprenticeship system. Specialization training would then extend for another one to one and one-half years, with the third and final examination conducted on the specialization area similar to the final examination in the German system.

Duty and Skill Standards Framework

The Vocational-Technical Education Consortium of States (V-TECS) has worked cooperatively with state vocational-technical education agencies to develop a framework for defining and describing occupational skill standards. This framework is used by many states, including Illinois, in defining state skill standards. The Illinois project started by using the V-TECS framework and was modified by the Illinois State Board of Education (ISBE). Project staff worked with ISBE staff to modify the framework to relate duty standards to a core set of basic enabling, advanced academic, and technical skill standards.

The metalworking industry and each occupational cluster within that industry are defined according to a core set of duty areas. Duty areas represent broad job responsibilities that are normally required of all employees within that occupational cluster or trade/profession. Each duty area is divided into one or more duties. Duty standards represent performance expectations in the workplace involving the integration and application of a wide variety of basic enabling, advanced academic, and technical skills. These duties represent broad role performances involving independent action and decision making. The Illinois project has recommended the establishment of seven major duty areas for General Production Technician occupations. These seven duty areas should be further broken down into 21 separate duties.

State systems for occupational skill standards should have a structure and format that puts the greatest emphasis on duty performance that addresses workers' abilities to independently plan, execute, monitor, and evaluate their work through the integration of basic enabling skills, advanced academic skills, and vocational-technical skills. These duty performance standards should be unpacked into separate basic enabling, advanced academic, and vocational-technical skill standards that must be mastered in order to successfully perform the duty requirements. This provides a simple structure of duty standards and a more complex relational structure of skill standards that could be necessary for more than one duty performance for a particular occupation.

As shown in Appendix B, the duty of Process Control, under the duty area Quality Control and Inspection, is presented in a standard summary format widely used in competency-based instruction in both education and industry (Mager 1984). These duty standards are stated so that students and workers can be assessed and certified through a combination of written and oral tests, performance examinations, and portfolio analyses based on projects. This duty standard should then reference specific skill standards in blueprint reading, industrial math, and precision measurement. These skill standards are stated in more precise and measurable terms, with more clearly stated mastery standards. An example of a skill standard is provided for precision measurement. In addition, the skill standards should reference state educational goals used to define high school

educational requirements for graduation or the attainment of high school equivalency certification. An example of such a reference is provided in Appendix B.

Although the specific content and format of this illustration represents only one possible way to approach standards in metalworking, alternative approaches should address the same set of design considerations discussed above. In particular, these approaches should emphasize independent role performance involving problem-solving and decision-making skills and the integration of academic and vocational-technical skills. These approaches should also relate duty performance to specific academic and vocational-technical skills identified in state learning goals and competency-based instructional systems in education and industry.

IV. Recommendations for Establishing a National-State System of Occupational Skills Standards in the United States

Strong international competition from Japan and Europe has led public and private leaders to look to other industrialized countries for more effective national models of workforce preparation systems. Although the use of occupational skill standards in the German Dual System provides useful lessons for the United States, we should develop our own unique strategy that will work best within the structure of American political and economic institutions. Occupational skill standards should be used as the foundation of state workforce preparation systems that coordinate public and private training investment through more market-based delivery systems (Sheets and Stevens 1991).

Step 1: National-State System of Industry Skill Corporations

The development of occupational skill standards first requires the establishment of a new public-private institutional structure that we currently do not have in the United States: a system of national and state industry skill corporations. Without this institutional structure, skill standards will not be used to improve and coordinate public and private training in the United States. Similar to the Central Committee of the BiBB in Germany, the national skill corporation should involve equal partnerships between the Departments of Education and Labor and between business and labor. However, the national corporation should be controlled and driven by the private sector. The national corporation should be charged with developing a national framework of core training occupations and skill standards that could be used as a starting point for state skill corporations, similar to what has been proposed in some states, such as Texas (Glover 1991). State skill corporations should be represented on the board of the national skill corporation. As described in the remain-

ing recommendations, the national corporation should be established to:

- Define government-recognized training occupations;
- Establish core national skill standards for each occupation; and
- Establish regulations and guidelines for state skill corporations in establishing state skill standards and related accreditation and credentialing systems.

State corporations should be required to develop compatible and consistent state systems that meet or exceed the core national standards and follow national guidelines in establishing additional skill standards at the state levels.

1. The federal government should convene national business and labor organizations to establish a national public-private corporation financed by government and business to develop and manage a national framework for skill standards for all government-recognized training occupations. State governments should convene state business and labor organizations to establish state skill corporations that will establish state frameworks that are compatible and consistent with the federal framework for all recognized training occupations.

Step 2: National-State System of Training Occupations

Federal and state governments and employers and unions have established a variety of occupational classification systems for a variety of different purposes. Most vocational education and job training programs are based on occupational and program classification schemes used by the NOICC-SOICC network in the United States. In following the lead of the German Dual System, the first task of a national skills corporation is to redefine our occupational framework to recognize "training occupations or trades" versus specific job titles defined through the DOT or SOC systems. We need to develop a new occupational classification system that will provide a crosswalk between detailed occupations and job titles and recognized training occupations. These should be built into the NOICC-SOICC system.

2. The federal government should establish a major initiative to define a national classification system for training occupations that has a crosswalk to any future revisions of the occupational classification system. This national system should be required in state occupational information systems and federal and state workforce preparation programs.

Step 3: National-State System of Occupational Skill Standards

The national skill corporation should use the national-state occupational framework to establish a core set of duty and skill standards for each nationally recognized training occupation. These duty and skill standards should represent world-class standards based on comparisons with leading companies in the United States and the standards established by our major international competitors. These standards should be developed by technical committees consisting of representatives from business, labor, education, and government. State skills corporations should take these standards as the framework for establishing higher or additional duty and skill standards based on unique state skill requirements. They should establish their own technical committees and be required to go through a structured review process under national guidelines.

3. The federal skills corporation should convene business and labor organizations to build consensus on national core skill standards for all major training occupations. State skills corporations should convene state business and labor organizations to review the national core standards and define skill standards above national standards or add additional skill requirements based on the skill requirements of state employers.

Step 4: National-State System of Professional and Technical Credentials

This national-state system of occupational skill standards provides the foundation for restructuring state licensing and certification systems. The federal skills corporation should establish broad guidelines for states to use in awarding credentials based on these standards. These guidelines should require states to reorganize their credentialing systems so that worker credentials are based on what workers know or can do rather than on how or where they learned these skills. States should be required to award credentials based on independent examination procedures administered through the state skill corporations or another independent organization. These new state credentialing systems should encourage worker mobility between public and private training systems and between states.

4. Federal skill corporations should establish general guidelines and regulations for the awarding of state credentials based on federal-state occupational skill standards. State skill corporations should reorganize state licensing and certification systems so that credentials are awarded based on independent assessment.

Step 5: National-State Performance Standards Systems

Federal and state governments should use these national and state skill standards and national-state credentialing systems to coordinate all workforce preparation programs around a common set of strategic goals that are operationalized through national-state performance standards systems. The U.S. Departments of Labor and Education should use the implementation of the new Perkins legislation to establish a common set of occupational skill standards and common performance outcomes in academic achievement and vocational-technical competence within their state-administered performance standards systems. States should expand this coordination strategy to include adult and higher education and JOBS programs wherever possible.

5. Federal and state governments should incorporate occupational skill standards into the performance standards systems of all workforce preparation programs. These standards should be used to evaluate the effectiveness of public and private training providers in training people to world-class standards.

Step 6: State Regulatory Policies for Public and Private Training Providers

States face a major challenge in expanding work-based training programs and integrating public and private training systems. A new national-state skill standards system provides the foundation for the expansion and integration of work-based training and private training providers into state workforce preparation systems. This should be done through innovative market-oriented funding strategies, including state discretionary grant programs and individual voucher systems (Sheets and Stevens 1991). These strategies will require the expansion of state regulatory policies to private training providers that use government funds as well as the establishment of a common accountability system for both private and public training providers. This accountability system should include a new accreditation system for both public and private providers that certifies training places as eligible to receive public funds and to prepare workers for recognized training credentials. This new accreditation system should be based mainly on the capacity of training places to prepare workers according to the recognized skill standards. This accountability system also should track the success of training providers in preparing their students for the state examinations.

6. States should use national-state skill standards systems to expand government-financed work-based training programs and improve the use of private training providers. States should establish similar regulatory policies for public educational institutions, private for-profit and non-profit training organizations, and companies. These policies should allow public and private training sites to receive government funds only when they operate in accordance with national and state guidelines (accreditation standards) and can demonstrate a good performance record in preparing students for state credentials.

Appendices for this paper can be obtained by calling the Education Line, 1-800-437-9799, or by writing to the Center:

National Center on the Educational Quality of the Workforce
University of Pennsylvania
4200 Pine Street, 5A
Philadelphia, PA 19104-4090

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National Center on
the Educational Quality
of the Workforce

University of Pennsylvania
4200 Pine Street, 5A
Philadelphia, PA 19104-4090

EQW APPENDICES

Appendices for the EQW WORKING PAPER:

Building a World-Class Front-Line Workforce: The Need for Occupational Skill Standards in State Workforce Preparation Programs

by Robert G. Sheets

Program Director
Human Resource Policy Program
Center for Governmental Studies
Northern Illinois University

APPENDIX A

Figure 1: Recognized Training Occupations in the Metalworking Industry

Figure 2: Occupational Description in the German Training Ordinance

Figure 3: Overview of Training Outline in the German Training Ordinance

Figure 1
Recognized Training Occupations in the Metalworking Industry

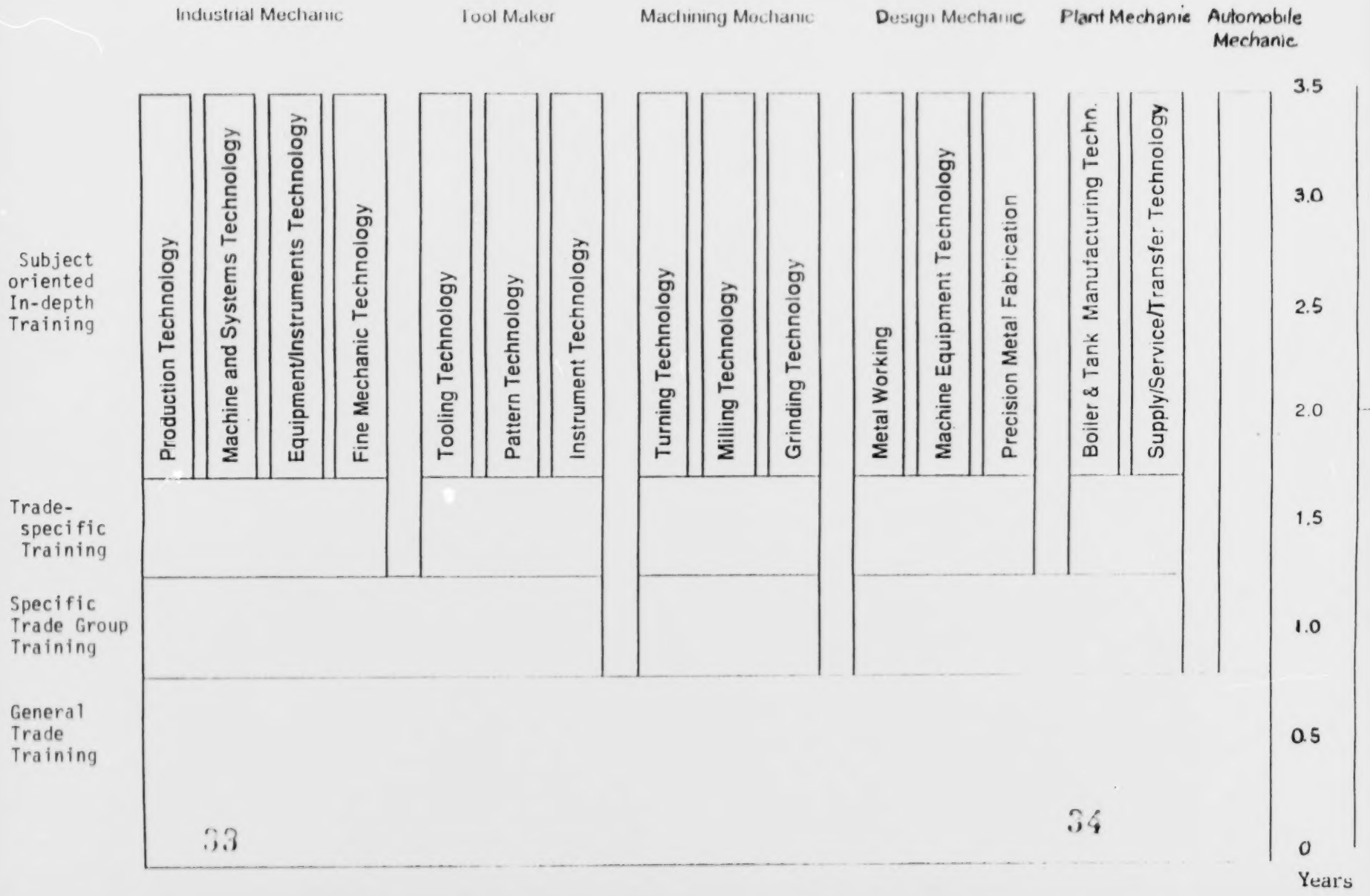

Figure 2
Occupational Description in the German Training Ordinance

INDUSTRIAL MECHANIC
TECHNICAL FIELD: PLANT TECHNOLOGY

Duration of Vocational Training: 3 1/2 Years

Work Area: On the basis of his/her vocational training the Industrial Mechanic in the technical field of Plant Technology is qualified to perform work assignments in the area of operating and resuming of operation of machines and equipment.

Their tasks can incorporate: inspections, maintenance, and repair of machines and equipment as well as adjusting operating equipment to changing conditions. They disassemble and assemble components and unit groups in order to maintain operating conditions, confine errors, eliminate interferences and effect restarting the machines or equipment after checking proper functioning.

These work procedures require a high degree of awareness as well as the ability to recognize the wear and tear conditions [on the machinery] and carry out or initiate appropriate repair work taking into consideration technical as well as economic considerations. Special perceptiveness and communicative skills are required for safety precautions at the repair place and the transport of the replacement and dismantled parts as well as in cooperating with other departments. Putting support beams or scaffolding into place needs to be accomplished with consideration for the remainder of the fully operating plant.

These tasks are mainly performed outside of production sites and repair shops at changing locations.

Figure 3
Overview of Training Outline in the German Training Ordinance

Educational Subjects	Time Standards per Week in Training Year 1	2	3/4
Basics of vocational training, corporate structure and organization of training facility, labor and corporate law, job protection, safety of work place, environmental protection and economical energy utilization	.	.	.
Reading, applying and writing technical documents, identifying, categorizing and handling work materials and operating supplies	4	4	4
* Planning and controlling of work flow and sequence of movements, checking and evaluating the results	5	6	
* Maintenance of work equipment and production facility	2	2	
* Quality control, marking off and labeling	3	1	
* Adjusting and clamping of tools and work pieces	2		
Manual cutting	8	5	
Machine cutting	4	6	
Separating, shaping	4	2	
Joining	8	2	
In-depth treatment of vocational basics training	12		
Installation and testing of pneumatic circuits,		3	
Assembly of unit elements and groups		18	
Testing and adjusting of single functions at unit groups by gauging and recording of data for work movements and production values		3	
Thermal separation, hot-shaping:			
Fusion welding			5
Installation and testing of hydraulic circuits as well as electrical components of control engineering systems,			15
Disassembly and assembly of equipment and unit groups			8
Installation, mounting, connecting of machines, equipment and unit groups			8
Transport and securing			3
Checking and adjusting of functions on unit groups, machines or systems			5
Recognizing, limiting and correcting errors and failures			16
Start up of machines or systems as well as maintenance of operating functions			14
	52	52	78

APPENDIX B

Example Skill Standards from the Illinois Tech Project: Figures A-1 through A-4

FIGURE A-1

Proposed Trades-Professions for the Metal Working Industry

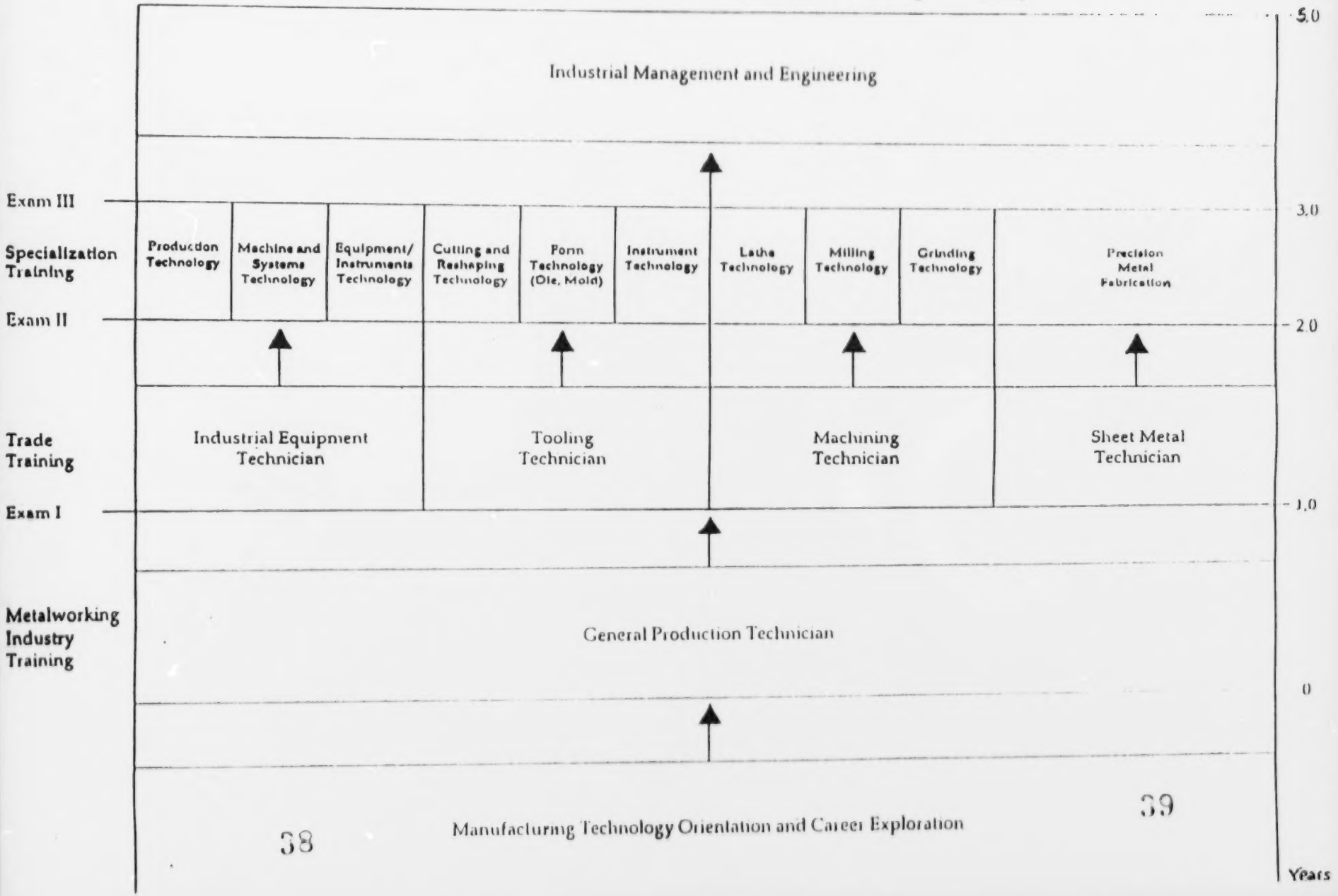

FIGURE A-2

Framework for Industry Skill Standards

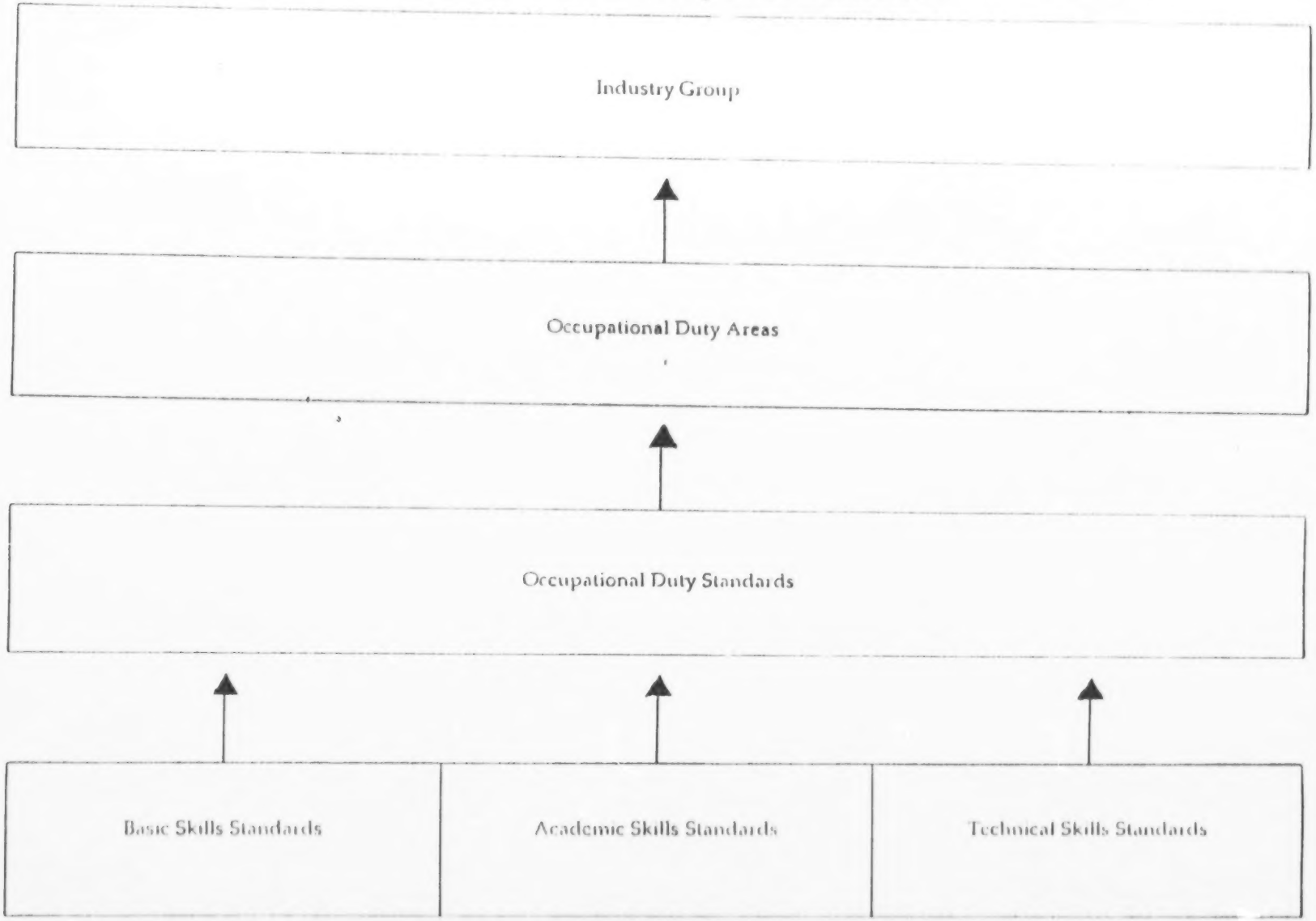

FIGURE A-3

Industry: Metalworking
Occupation: General Production Technician
(Machine Setup/Operators, Assemblers)

Core Duty Areas and Duties

1. Job Planning and Management
   - 1.1 - Job Process Planning
   - 1.2 - Job Cost Estimation
   - 1.3 - Job Cost Analysis

2. Job Execution
   - 2.1 - Benchwork Operations
   - 2.2 - Machine Tool Operations
   - 2.3 - Assembly Operations

3. Quality Control and Inspection
   - 3.1 - Inspection Planning
   - 3.2 - Process Control
   - 3.3 - Purchased Material Inspection

4. Product and Process Improvement
   - 4.1 - Job Process Plan Improvement
   - 4.2 - Job Operations Improvement

5. General Maintenance
   - 5.1 - General Housekeeping and Maintenance
   - 5.2 - Preventive Maintenance

6. Industrial Safety and Environmental Protection
   - 6.1 - Machine Operation and Material Handling
   - 6.2 - Hazardous Materials
   - 6.3 - Material Disposal

7. Career Management and Employment Relations
   - 7.1 - Career Planning
   - 7.2 - Job Application and Interviewing
   - 7.3 - Job Performance and Evaluation
   - 7.4 - Teamwork and Interpersonal Relations
   - 7.5 - Employment Rights and Responsibilities

FIGURE A-4

DUTY AND SKILL STANDARDS FOR GENERAL PRODUCTION TECHNICIAN

Industry: Metalworking
Occupation: General Production Technician
Duty Area: 3. Quality Control and Inspection
Duty: 3.2 Process Control

Duty Performance Standard:

Given a manufacturing instruction sheet for a machining operation including information on quality requirements, inspection procedures, and measurement instruments, a standard X-R control chart with upper and lower control limits, and a set of 30 5-piece samples of parts produced from the machining operation, inspect all sampled parts and complete a variable X-R chart. Using this chart, prepare a written report and make a 10-minute oral presentation on procedures, results, and conclusions including recommendations on whether to stop or continue production.

Related Academic-Technical Skill Performance Standards:

1.	Precision Measurement	1.1 - 1.7
2.	Precision Measurement	1.15 - 1.16
3.	Blueprint Reading	1.1 - 1.10
4.	Industrial Math	1.1 - 1.10, Math Goal 14
5.	Reading Comprehension	Level 3, Language Arts Goal 3
6.	Written Communication	Level 3, Language Arts Goal 15
7.	Oral Communication	Level 3, Languate Arts Goal 23
8.	Problem-Solving	Level 2, Math Goal 23
9.	Learning to Learn	Level 2

Precision Measurement 1.2 - Vernier and Dial Caliper

Skill Performance Standard:

Given three common types of prints and parts from the metalworking industry and access to a vernier and a dial caliper, demonstrate the ability to read and set dimensions and show the proper uses for each type of part and complete required part measurements within 15 minutes with 100 percent accuracy within a plus or minus of .001.

Demonstrated Knowledge and Skills:

1. Describe the three main functions of a caliper
2. Identify the major uses of a vernier and dial caliper for each part type
3. Demonstrate how to properly use and accurately read a vernier and dial caliper.